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# ***JPRS Report***

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# **Science & Technology**

***Europe  
EC Commissioners Evaluate Electronics,  
Computer Industries***

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# Science & Technology Europe

## EC Commissioners Evaluate Electronics, Computer Industries

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## Preface

The European Commission gave its approval on March 26 to a communication in which Commissioners Bangemann (Industrial Policy) and Pandolfi (Industrial Policy) describe in critical terms how the Community's electronic and computer industry is faring compared with its Japanese and American rivals and propose practical steps to make good the shortcomings and give the industry the punch it needs to face up to international competition in this strategic sector.

During a press conference in Brussels on March 26, Fillipo Maria Pandolfi explained that the idea was not to develop a sector-based policy but to apply the whole gamut of EEC policies to the strategic fields of data-processing and electronics. Mr. Pandolfi said that the communication's purpose is to propose an updated series of measures and guidelines to help the Community's industry make a bigger impact on the world market.

Tech Europe's document features the Commission's analysis of the situation and the steps it is recommending to give a boost to European companies and help them overcome the major difficulties they have been experiencing for some time now.

## A. Introduction

1. In November 1990 the Commission adopted a **communication on industrial policy**.<sup>1</sup> While placing the main responsibility for improving industrial competitiveness on firms, the Commission indicated that it was up to the public authorities to provide them with a clear and predictable framework and outlook for their activities.

The industrial policy approach adopted by the Commission and approved by the Council is based on the concept of Community interest, on past experience of industrial adjustment and on the overall industrial challenges which the community must be prepared to tackle.

It focuses on the importance of the single market to industry and on the application of the competition rules at international level to ensure, on the basis of a balance of rights and obligations, that competitors' markets are as open as the Community market. In its industrial policy paper the Commission also comes out in favour of pursuing positive adjustment policies, including a technological development policy; such policies are regarded by the Commission as complementing the open and competitive environment needed in the context of the single European market.

2. This open, horizontal and offensive approach has a natural application in the **Community's electronics and information technology (IT) industries**, which are facing severe structural adjustment problems at present. In view of the "enabling" nature of these industries and their external effects on the economy as a whole, they are often regarded as strategic. In the run-up to the completion of the internal market and the increasingly global

dimension of the economy, a better supported approach could be based on the following questions: do the actual conditions of competition allow European industry to be effective? What policies are appropriate in order to stimulate our competitiveness?

3. These industries provide three main categories of products and services: components,<sup>2</sup> which are the basis of any electronic equipment or system; computers, consisting of hardware, peripherals, software and office and industrial automation applications;<sup>3</sup> and finally consumer electronics.<sup>4</sup> These are the industries which are the subject of this communication.

Other allied high-growth industries, e.g. the industries which provide audiovisual services, telecommunications equipment and services, and on-line data base services, are not discussed in this communication, but may be covered by separate communications.

4. Taken as a whole, these industries have certain specific features, contributing as they do towards the compilation, creation, communication and application of something which may be regarded as a new resource, namely information.

They are already important in their own right, with a worldwide turnover of 700 billion European currency units [ECU] in 1990 and a Community-wide turnover of ECU175 billion. Their rapidly expanding market now represents 5% of GDP and will be nearing 10% by the year 2000.

However, they also constitute an infrastructure through the "enabling" nature of the technologies developed by them. The closely interdependent group formed by these rapidly developing new technologies provides the hardware, software and application systems now used in virtually all economic and social activities. As a result, these industries have a major part to play in the competitiveness of industry and the quality of services, in particular public services of general interest.

The impact on employment is considerable. It is estimated that between 60 and 65% of the working population is directly or indirectly affected by these technologies and their applications.

5. This communication has been written at a time when many of these industries are in difficulty, especially in Europe. This state of affairs calls for an analysis without complacency, and in a world context, of the situation in this sector, the causes of the difficulties encountered and the respective roles to be played by and the challenges to be faced by the firms and the public authorities.

The communication follows a double approach in order to enable the European industry to be more competitive on its own and on the world market:

— to contribute to the examination of the relative industrial and technological conditions of the Community's electronics and IT [information technology] industries. This examination analyses the situation

by looking at all the players concerned in Europe and the world as a whole, taking into account the progress towards a single European market which is still influenced by structures and behaviour bound up with the fragmentation of the Community market and subjected to international competition with very contrasting rules.

- to set out, in keeping with the industrial policy paper mentioned at the beginning, a consistent package of measures which the Community and the Member States would be prepared to implement. It must be made clear, however, that this initiative will be pointless and impracticable unless it is based on clearly defined medium and long term objectives set by the industry and on specific commitments from their side.

## B. The Situation of the European Industry

6. Annex I contains a detailed quantitative analysis of the situation of the industry in Europe and worldwide. The following prominent features emerge from it:

- the electronics and IT industry in Europe and the world as a whole is expanding considerably, particularly on the demand side. Market studies suggest that this expansion will continue at least until the end of the decade, making this industry even more important than it is today.
- The background to the development of these industries in the world as a whole makes it easier to understand the current difficulties of the European industry. The causes are examined in greater detail in Section II below. As a result of them, despite the strengths and the genuine efforts made to face up to technological changes and new market conditions (establishment of the single market, and globalization) the European industry has weaknesses and shortcomings which give grounds for concern.

### A Major and Rapidly Expanding Industry

7. The European electronics and IT industry has achieved great importance in a particularly short space of time. With a growth rate of around 15% per annum in the 1980s, well in excess of the GDP growth rate, it has caught up with other major Community industries such as the chemical industry and the motor industry. Between 1984 and 1989 the turnover for this industry as a whole more than doubled, rising from ECU55 billion to ECU130 billion. Allied to the telecommunications industry, which both drives it and is driven by it, the electronics and IT industry now represents nearly 5% of GDP in Europe compared with 5.5% in Japan and 6.2% in the United States.

The trend since 1980 in world production for all the electronics and IT industries, together with telecommunications, by main geographical areas, is as follows<sup>2</sup>:

- American production is pre-eminent in absolute terms but falling over time (37% in 1990 compared with 46% in 1980),
- Japanese production has increased considerably in both absolute and relative terms (24% in 1990 compared with 15% in 1980),
- the European industry's comparatively modest production level has remained fairly stable (24% in 1990 compared with 26% in 1980), although there are major differences between sectors.

Demand in Europe represented a quarter of world demand in 1984 and a third in 1989. With the single European market, the driving role of the European market will increase. The forecast for the year 2000 is for sustained demand growth in the "triad": 11% for active components, 11% for computers and 4% for consumer electronics.

### Strengths and Restructuring Efforts

8. The European electronics and IT industry has considerable potential and in recent years has made significant progress in certain areas, in particular in software and computer services and in industrial automation.

There are in the Community some 13 000 computer services and engineering companies whose strengths lie in particular in the integration of customized software and systems. In 1989 Siemens, Bull, and Olivetti ranked for the first time among the top ten computer companies, though admittedly a long way behind IBM, whose turnover is nearly three times their combined turnover. The European advanced manufacturing equipment industry (numerically-controlled machine tools, industrial robots etc.) has regained its position of world leader, pursued by Japan and well ahead of the United States. Alongside the electronics and IT industry, the European telecommunications industry has considerably strengthened its competitive position, with Alcatel and Siemens in first and third places respectively in the world.

Europe's university and research structure possesses a wealth of differentiated cultural and intellectual resources. The situation as regards research and technological development has changed substantially since 1980. The Community programmes (ESPRIT [European Strategic Program for Research and Development in Information Technologies], RACE [Research and Development in Advanced Communications in Europe], BRITE [Basic Research in Industrial Technologies for Europe]) and EUREKA [European Research Coordination Agency] have helped to mobilize human, financial and technological resources. Their catalytic effects have helped to encourage joint analyses, develop inter-firm cooperation and consolidate the technological base.

The European companies operating in these areas employ over 800 000 highly-skilled workers in the Community and approximately 1 100 000 in the world as a whole.

To face up to the current difficulties, the European firms are engaged in restructuring operations: they are stepping up their efforts to reduce costs and increase their productivity, and are striving to speed up their response to rapid changes in demand. These restructuring efforts are costly and entail significant job-shedding. Many of them are refocusing their activities on markets with a promising future (Olivetti in microcomputers and work stations, Philips in consumer electronics, etc.), and adjusting their operating and distribution structures.

### Weaknesses

9. Despite this growth, these strengths and this technological potential, there are worrying weaknesses and shortcomings. An analysis of the situation of the Community industry indicates a limited presence in certain key sectors: semiconductors, peripherals, consumer electronics, and a precarious situation in computers. Apart from the consequences for the balance of trade, this situation obliges European companies to obtain supplies of certain vital components from their competitors, which impedes their decision-making ability.

In **semiconductors**, Japan has a 49.5% share of production compared with 36.5% for the United States and 10% for Europe.

**Computer peripherals** (discs, printers, screens, etc.) are manufactured to a large extent in Japan (40% of world production) and to a lesser extent in the United States (25%). Production in Europe accounts for only about 15%.

In **consumer electronics**, Japan accounts for 55% of world production and has control over 99% of its domestic production, 27% of production in Europe and 20% of production in the United States. The Community industry accounts for nearly 20% of world production.

In **computers**, production in Europe only covers two-thirds of internal demand, and 60% is accounted for by firms of American origin (IBM, DEC, Hewlett-Packard).<sup>6</sup> After staging a significant recovery between 1984 and 1987, the Commission industry has again lost ground in Europe.

Overall, therefore, the increased demand for electronics and IT products and services in Europe is being met only to a limited extent from European sources. Production in Europe covers about 75% of consumption in the electronics and IT sector, as compared with 140% in Japan. This imbalance has generated a trade deficit in Europe which has worsened since the start of the 1980s. For electronics as a whole, it was ECU31 billion in Europe compared with a surplus of ECU57 billion in Japan and a deficit of ECU7 billion in the United States. Europe's deficit is mainly attributable to trade in components (deficit of ECU-5.6 billion), computers (deficit of ECU-15.3 billion) and consumer electronics (deficit of ECU-9.6 billion) in 1989. This balance-of-trade position indicates that the Community industry is not competitive enough in these sectors. The growing internationalization of the economy means that European firms must be

able to invest increasingly abroad. These investments and cooperation arrangements should allow a further improvement in firms' competitiveness.

10. An analysis of the situation of European firms on the European and world markets indicates different positions depending on the areas of activity and, as a whole, major differences of scale in comparison with American and Japanese firms.

The **world semiconductor market** is dominated by Japanese firms (NEC, Toshiba, Hitachi, Fujitsu, Mitsubishi) which account for nearly 90% of world production of high-capacity memories, and by the American microprocessor manufacturers (Intel, Motorola) which control over 80% of world production of 16 and 32 bit microprocessors (the most popular at present).

Investing 15% of their turnover in R&TD and 13% on average in manufacturing equipment, the European firms (Philips, SGS-Thomson, Siemens - tenth, twelfth and fourteenth in the world rankings respectively) have still not achieved the critical threshold of 5% of the world market. The turnover of the second manufacturer of semiconductors in the world (Toshiba) is higher than the combined turnover of these three manufacturers.

In **computers**, American firms are in the lead with five of the top ten companies, the biggest of which, IBM, dominates the world market as a whole. The Japanese firm Fujitsu has moved into second place following its acquisition of ICL. The share of the European market held by IBM is greater than that of Siemens/Nixdorf, Bull, Olivetti and Philips together. The latter have increased in size as a result of outward expansion and by acquiring other firms: Bull has acquired 85% of Honeywell Electronics and 51% of the IT division of Zenith (United States). Siemens recently bought Nixdorf. The significance of the investments made is considerable: on average 10% of turnover is spent on R&TD, 10% on investments in capacity and 10% of the wage bill is made up of training costs. However, the Community industry consists of virtually the same (medium-sized) firms as ten years ago. Many of them recently had poor financial results (high losses for Bull, Nixdorf, Philips), as did the main American manufacturers in fact (DEC, Unisys, Hewlett-Packard, Wang). Unlike the computer manufacturers, the software and IT services companies (CAP Gemini Sogeti, SEMA Group, Logica, etc.) are in a strong, though vulnerable, position.

In **industrial automation**, Europe has major trump cards with Siemens, Comau-Fiat, Renault, GEC, etc. and a wealth of efficient SMEs [medium-sized enterprises], especially in Germany and Italy.

In **consumer electronics**, apart from Philips and Thomson, which respectively occupy the third and sixth places worldwide, Japanese companies, with Matsushita and Sony in the lead, dominate the industry. The only other non-Japanese firms in the top dozen are Korean, Samsung and Goldstar at 9th and 10th. Philips and Thomson hold very strong positions in the US through their subsidiaries Philips North

American and RCA and are at the forefront of HDTV [high-definition television] research there. US industry is barely represented in this sector; Zenith, the best placed American firm, ranks only 16th.

Despite the high rankings held by European companies, their strengths reside generally in the more mature technologies, and their shares in the newer products are declining (e.g. camcorders).

## C. The International Context

### I. Developments in Europe and the World

11. Historically, the development of the IT and electronics industries has been influenced by the structure of demand, features of the market and the attitude of the public authorities.

Three main categories of users have shaped these features.

**The public authorities.** Public procurement, although it currently represents only 15% of the market for these industries, has long made its mark on them. It involved heavy and expensive equipment (miniaturized equipment, distributed computer systems and the liberalization of telecommunications being relatively recent phenomena). Orders placed by national public bodies, such as for mainframe computers or telephone exchanges, have created captive, protected markets throughout the world. Public procurement has thus helped national champions to emerge and proprietary standards, often incompatible, to develop. These features are blurring; public procurement is becoming more commonplace with the emergence of distributed products and systems. In Europe, with the completion of the internal market, public procurement is gradually being opened up to competition. However, European IT and electronics firms have inherited a dependence on national buyers, proprietary standards and telecommunications infrastructures which are not properly interconnected at European level. The European market is still fragmented, which limits economies of scale and reduces size and networking effects.

**Firms.** The products and services of the IT and electronics industry have become an essential element of productivity, flexibility and competitiveness for almost all of the productive fabric. They provide innovative elements such as electronic components for the motor industry and have now become indispensable production and design tools: computer-aided manufacturing and engineering, computerized telecommunications networks, workstations, applications software, etc.

Firms face a twofold challenge: gaining access to the most innovative IT and electronics products, with optimum price, delivery and after-sales service terms, and also organizing themselves to exploit their potential to the maximum. Trade relations between manufacturing and user firms, the existence of a large market for

standardized hardware and applications, and the presence of leading-edge users, are now essential preconditions for growth in the IT and electronics industries. These conditions differ from those prevailing in the United States and especially in Japan.

**Individual consumers.** Their market is mainly consumer electronics and associated services, but also, increasingly, products originally designed for business use (minicomputers, etc.). It is a mass consumer market which makes severe demands on manufacturers in terms of cost and quality. This market is highly competitive, is subject to a high rate of innovation and involves taking major risks in the introduction of de facto standards. To remain competitive, firms must sustain a constant R&TD and innovation effort, and have substantial financial, production and commercial resources.

12. History also influences the conditions for the growth of these industries throughout the world.

In the **United States**, the power of the IT and electronics industry was built up in the sixties. Stimulated at first by the major military and space programmes, large groups consolidated their positions. The vitality and receptiveness of the American market, businesses' entrepreneurial spirit and the workings of competition allowed many medium-sized firms (start-ups) to gain a foothold on the market and a rich and lively fabric of small and large firms to develop. Focusing originally on mainframe computer systems, in the seventies the American industry concentrated on minicomputers, in the eighties on personal computers and today on open and distributed systems. At the same time the software industry grew up, nourished by successive generations of hardware (the "proximity effect").

The American computer and components industry is still powerful, even though it has been experiencing difficulties since 1980 in the face of Japanese competition. On the other hand, the American consumer electronics industry has almost disappeared: the American market, which is open and competitive, is now dominated by Japanese and European firms.

In **Japan**, the industry has grown and gained strength along a number of different paths. Japanese growth is not solely the result of market forces, but rather of long-term strategic planning in which the public authorities play a central part. The objective was to rebuild the Japanese economy and commercial and technological interdependence with a view to achieving a very strong presence on the world market. The method used has been to consolidate and exploit an economic and political system which ensures close cooperation between the public authorities and industry, accompanied by selective public financing. It has given rise to structural protection

of the domestic market and strong horizontal and vertical integration of the industrial groups, banks and distribution.

This complex "controlled market" system has created favourable conditions for the growth of new industries including IT and electronics. The industry's development strategy has relied primarily on consumer electronics. Success in this area has led to a chain reaction: technological skills and breakthroughs, success with complex production processes, quality control, rapid innovation. These advantages then ensured Japanese success in the production of memories and later, peripherals. Japanese industry seems to be implementing a strategy to gain control of the world electronics market by gradual stages: after consumer electronics, components, now computers and maybe, by the end of the century, telecommunications.

Japan has inherited from the past a technologically, industrially and financially strong industrial structure, a structurally protected national base and a strong capacity to innovate. To make up for its relative weakness in research, it launches well targeted international cooperation initiatives.

For a long time in Europe, in the absence of a true Community market, the development of the IT and electronics industries and the industrial and technology policies adopted by the Member States were conceived on a national basis. The confines of the national markets, the difficulty in penetrating other Community markets and a certain reluctance to tackle other markets have weakened the Community IT and electronics industry as a whole. Not only were national champions able to achieve only limited economies of scale and networking effects, but also synergies between Community manufacturers and users from different Member States failed to materialize. At the present time, no Community IT and electronics manufacturers, not even among the largest, has a European image, especially in the eyes of the major user industries. For certain countries, the defence sector has been able to create captive markets and limit the stimulating role of competition on industry's ability to innovate. In consumer electronics, the segmentation of the Community market has paradoxically been able to protect European manufacturers from the Japanese, who have concentrated on the American market which is homogeneous and open.

The European market and its industry are now undergoing radical changes. Much work has been done at both national and European level: industrial R&TD work and many restructuring initiatives have been stepped up, major national technological programmes have been launched, Community intervention has increased through the various Community programmes, EUREKA has been a mobilizing force, and markets have been opened up through the internal market. Despite these efforts, Europe is still suffering from the consequences of long-term fragmentation of its markets and its firms' difficulties in setting medium and long-term objectives.

European industry must adapt its structure to the Community and world dimension, but this cannot but be a long and costly process.

13. In addition to these difficulties rooted in the past, European industry faces the phenomenon of **globalization**. Increasingly exploited by the more powerful firms, principally American and Japanese, it allows them to make up for certain gaps in their basic expertise, meet constantly rising R&TD costs and the shortening of product life, and to benefit from the high rate of technological innovation. Globalization also allows them to take advantage of differing competition conditions on the world market. For European firms facing fiercer competition on their own domestic markets, it is becoming essential for them to weave complex webs of cooperation arrangements, in particular by creating technological and commercial cooperation networks at both Community and national level. For the Community public authorities, it is becoming important to ensure, in this context of globalization and on the basis of balanced rights and obligations, that its competitors' markets are as open as its own.

## II. The Causes of the Present Situation in This Context

14. Certain causes are of a **cyclical** nature. To begin with, the adverse effects of the economic cycle characterized by a slowing down of growth are being aggravated by the fall of the dollar and the yen in relation to the ECU. With the **depreciation of the yen and the dollar**, competitive pressure from Japanese and American goods on the European market has grown sharply.

15. Most are **structural**, however, and have been highlighted by the poor general economic climate of the 90s. They are manifold and interrelated. In order to analyse them, we will use the latest theoretical models<sup>7</sup> developed for the study of the competitive advantages of nations and apply them to the European IT and electronics industries. The analysis is based on four elements: demand conditions, factor conditions, related and supporting industries, and firm strategy, structure and rivalry<sup>(8)</sup>.

In addition to these factors, unequal competition conditions are accentuated by the public authorities.

### Demand

16. The Community market has inherited a **high degree of fragmentation** in relation to the other large markets in America and Japan. This has particularly serious consequences for the European IT and electronics industry:

The limited scope of its markets, often still confined to the national level has restricted the exploitation of economies of scale. European firms are therefore faced with higher unit production costs than their competitors. This is even more of a handicap since its effects are dynamic and cumulative.

For the same reasons, European firms have not been able to exploit "network externality" effects. These effects appear when a user's choice is influenced by the size of the firms concerned or the total number of users of the products he wishes to buy.

These networks attract users and they become captive for reasons unrelated to price, but linked to the difficulty of converting existing hardware, a wide range of compatible products or services, and the life of the networks. The segmentation of the Community market has restricted the size of networks and the number of users for European firms.

The former development of proprietary standards and systems, long used to create captive national demand, becomes a handicap at a time when European firms, which have never commanded sufficiently large markets to impose their standards, are obliged to change to open standards and systems. This essential change is called for by users but it does have the effect of eroding European computer hardware manufacturers' profit margins since the markets for open systems are more competitive. It also increases their costs, since the old and new generations of equipment have to be maintained simultaneously during the transitional phase from one to the other, while maintaining compatibility with dominant proprietary systems.

**17. The lack of leading-edge users<sup>8</sup>** in Europe, in contrast to the United States and Japan, prevents the European IT and electronics industry from exploiting all the advantages of being first to market in new fields. However, for the development of the IT and electronics industries, the existence of a dynamic and demanding market plays a decisive role. The quality of demand is as important as quantity. The advantages of leading-edge demand are not only technological, but also commercial and financial. Indeed, it is during the period when a product is introduced that prices are high and profit margins sufficient to release the resources needed to finance R&TD and prepare subsequent generations of products.

### Supply

**18. Competition conditions are unequal** between different areas. On a market which, in the case of IT and electronics, is worldwide, and where certain firms must employ a global strategy to survive, these differences become economically decisive and pose a political problem. While the degree of competition and openness to direct foreign investments is increasing in Europe with the completion of the internal market, certain foreign markets are still practically closed to the penetration of Community investments and products. While European firms must step up their efforts, and invest and develop partnerships in third countries, there are many reasons why they may come up against barriers to such initiatives. At a time when competition rules are becoming stricter in the Community, in other competing areas measures relating to concentrations and aid

allowed are becoming more flexible or are sometimes remaining less strict. This state of affairs facilitates or on the contrary makes very difficult, depending on the internal markets of firms, their simultaneous presence or the distribution of their products throughout the world. The same applies to the concentration and vertical integration facilities offered to them.

**19.** Similarly, in view of the considerable volume of investments in R&TD and production capacity, **financing conditions** militate against the IT and electronics industries in Europe. In contrast to the United States, the financial system is reluctant to invest in start-ups. In contrast to Japan, the cost of financing R&TD and capacity investment is high in Europe and access to financial resources is difficult in the case of long-term or high-risk operations<sup>9</sup>. This allows Japanese firms to devise a long-term development strategy and invest at lower cost.

**20. Availability of skilled staff.** Rapid technological advances have made the European IT and electronics industry heavily dependent on highly skilled staff with state-of-the-art knowledge. However, in the labour market there are not enough engineers and researchers with recent training in the production, adaptation or use of these technologies. For the same basic population, Japan trains 80 000 engineers a year as compared with 41 000 for Germany and France together. Due to a lack of qualified staff (systems engineers, staff trained in computer-aided management), user industries and small businesses in particular are unable to make the most of competitive openings arising in the IT field. This means that demand on the European market is less advanced and less receptive to innovations than in the United States or Japan.

### The Structure of the European Productive Fabric

**21.** The relations between the IT and electronics industry and the surrounding industrial and scientific fabric are crucial. They can take many forms: access to basic knowledge depends on relations with scientific circles; knowledge of market needs, and users' ability to develop leading-edge markets depend on relations between manufacturers and users. Relations within and between industries allow the exploitation of complementary features and technological and commercial interdependences within the IT and electronics product family, and between small and large businesses. All these relations result from the compactness, solidity and dynamism of the productive fabric around industrial and scientific poles of competitiveness.

In Europe, **vertical integration** of IT and electronics firms is relatively limited in comparison with American and especially Japanese firms. It failed in the past because European computer manufacturers tried to generate upstream business by making components, but only for their own needs. Since the markets within firms were insufficient, they were not able to reach critical production volume thresholds. On the other hand, this strategy



has led to beneficial results for certain American groups, notably IBM, which were large enough to guarantee sufficient outlets within the enterprise. In Japan, vertical integration has succeeded since component production by consumer electronics or IT firms was oriented towards the export market, regardless of the cost. Groups such as Toshiba, Hitachi, NEC and Fujitsu belong to the top ten companies in the world in two and sometimes three segments of the components-IT-consumer electronics chain simultaneously. Inadequate integration in European firms, in relation to their American and Japanese competitors, is a handicap, particularly as far as components are concerned.

Although there is plenty of cooperation on precompetitive research in Europe, **cooperation arrangements on the development** of new products are all too few and far between. For certain products such as memories, liquid-crystal displays (or HDTV), they are or will become indispensable, in view of the human, technological and financial resources which can only be mobilized on a European scale.

Finally, the structure of the European productive fabric also has gaps in it as far as **relations between manufacturers and users** are concerned, which is a hindrance notably for start-ups and in complementary arrangements between large and small companies. Such relations exist in software and applications - where European competitiveness is high - but are generally insufficiently developed.

#### European Business Strategy

22. With the exception of precompetitive R&D, the **industrial strategy of Community firms has failed to take sufficient account of the Community dimension and long-term prospects**. Opportunities for cooperation with Community and international partners have not been fully exploited. As regards innovation and production, European firms have failed to take full advantage of the opportunities for cooperation created by the major Community technology programmes and have not put long-term global strategies in place early enough. In this context, we should consider whether R&TD policy has not been too limited to the precompetitive area. It has however been Commission policy up to now to leave near market research to the companies themselves so as to maintain the incentive for them to compete through innovation.

European firms must simultaneously sustain their R&TD efforts and capacity investments, manage their change towards both the Community and world markets and assimilate the many internal and external restructuring operations which they must carry out, while losing no time in finding a place on the most promising and innovative market segments which many have yet to enter (peripherals, microcomputers and portables). This requires considerable financial resources which they can raise neither internally, as competition is fierce, nor

externally, as the financial system in most Member States is not properly geared to financing long-term or high-risk operations.

The European IT and electronics industry's R&TD investment capacity needs are considerable. In the recent past European firms have made great efforts: on average they spend as much as their American or Japanese competitors **in relation to their turnover** (some 9.5% and 8.0% of sales are spent on R&TD and capacity investment respectively). The financial resources to be mobilized for the seven largest European firms amounted to around ECU14 billion in 1989. Despite these efforts and taking account of their relatively small size, these resources are still lower than the investment expenditure of the six largest Japanese firms (ECU22 billion) and seven largest American firms (ECU20 billion).

23. European firms have a high-quality technological base, but **fail to bring enough innovative products onto the market quickly enough**. There is a shortage of new firms in Europe, especially small ones, to exploit the new market openings which are constantly arising through rapid technological development. There are three reasons behind this: the first is the hesitant market. The second concerns finance: firms have insufficient financial resources and banks are reluctant to take risks. The third results in particular from the shortage of skilled staff in systems management.

**The inequality of competition conditions is accentuated by public authority involvement**

24. The structural characteristics of the IT and electronics market described above (substantial economies of scale and learning, high entry and exit costs) lead the most powerful firms to acquire dominant positions, build barriers to entry, form cartels or closely control the use of certain technologies, subcontracting networks and distribution systems. In addition to these imperfections of the market, various failures of the competition mechanisms appear: external effects between activities or geographical areas, public facilities, especially R&TD where private production is insufficient and information incomplete or unbalanced. These failures call for information, coordination and stimulation functions which the pricing system alone, however 'perfect' it may be, cannot provide.

These imperfections and failures of the market mechanisms, and also the economic and social importance of the IT and electronics industries have encouraged the public authorities of the major economic zones to pledge support to the industry and provide it with a competitive advantage on a local basis.

25. In the United States the public authorities have taken part in an intense debate on maintaining American technological supremacy using national security as the main pretext, and have widened their range of economic policy instruments. The involvement of the public authorities has taken on various forms.

Massive orders for hi-tech equipment are being placed by various departments and agencies (in particular the Department of Defense), and expensive R&D programmes, backed up by the creation of university networks, are underway. The implementation of competition laws has been watered down. Special procedures apply in certain sectors with regard to foreign firms carrying out their activities in the U.S. The implementation of the "Buy American Act" enables preferential treatment to be given to American firms.

Discrimination against American firms of foreign origin as regards R&TD is being practised by the Department of Defense, and Sematech is one example here. As negotiations stand at present, the GATT [General Agreement on Tariffs and Trade] rules are applied in a selective fashion.

Bilateral pressures (Super 301) to obtain reciprocity, based on the 1988 Omnibus Trade and Competitiveness Act, aim to allow American firms to penetrate third countries' markets, under threat of unilateral retaliatory measures (the Community has been designated a "priority country" for telecommunications); at the same time, the U.S. is calling for "national treatment" from its trading partners which would like to see reciprocal opening-up of the markets.

26. In Japan, the policy of the public authorities is based on various instruments with mutually reinforcing effects: backing for business cooperation in terms of strategic planning and of scientific and technical cooperation; virtual closure of public procurement to foreign companies while ensuring a high degree of internal competition; support for the setting up of major diversified vertically and horizontally integrated groups, capable of sustaining for several years the losses incurred by the market launch of new products usually manufactured on the basis of technologies originally acquired externally. Japanese industry is geared to long-term strategies. The "Keiretsu" also provides a high level of cooperation and solidarity between Japanese firms.

The Japanese market is protected structurally by the way the productive system is organized, with support from the public authorities. The big Japanese conglomerates generally have a dual banking and commercial focus. The banking side takes care of the financing, according to the group's strategy, of long-term or high-risk operations such as research and the production of innovative products. The sales and distribution side (notably in consumer electronics) deals with the promotion of products, market research and control via the captive markets created between the companies in the group.

Comparative studies show that the prices charged for certain equipment in Japan are far higher than in other parts of the world.

27. The other Southeast Asian countries have also greatly consolidated their foothold in the IT and electronics industries, in particular via long-term technological

development programmes (such as the ten-year "Submicron Process Technology Development" programme in Taiwan) and an intensive investment strategy.

28. The Member States have all developed their own R&TD policies accompanied by different instruments and have launched numerous national and international initiatives (such as the European Space Agency, the Eureka initiative and aeronautical and military cooperation projects).

The Community, so far with very limited powers in the field of defence, has concentrated on the completion of the internal market, an essential step to make firms look, think and act beyond national frontiers. It is also committed to the strict application of the law concerning the competition conditions set out in the Treaty, the liberalization of telecommunications in the same spirit, and in particular the implementation of a major technological cooperation policy, more for the stimulus it provides than for the scale of financing involved.

Committed to a policy of opening up to competition, it has actively promoted a standardization policy in favour of open systems geared towards hardware compatibility. It has decided to promote the development of trans-European networks which, through their structural effects, will ensure that full economic and social advantage is taken of the completion of the internal market. These trans-European networks relate in particular to computerized communications service vocational training networks.

As far as trade is concerned it has endeavoured, so far with limited success, to obtain from its main trading partners an open, multilateral international trade system, ensuring, on the basis of the principle of balanced rights and obligations, that its competitors' markets are as open as its own.

It has also been concerned to continue the integration of the European markets by new agreements with the EFTA [European Free Trade Association] and east European countries.

These are all positive measures. They have not yet managed, however, to offset the failures of the market and imperfections in competition which characterize the IT and electronics market.

## D. A Community Approach

### I. A Reference Framework

29. Measures to be taken to restore the competitiveness of the electronics and IT industry depend on firms themselves taking the initiative and facing up to their responsibilities, and on their capacity to make the most of the new opportunities presented by the single European market.

Despite their present difficulties, firms must follow a long-term strategy which allows them to maintain and

step up action to increase productivity, modify their operating and distribution structures, anticipate technological developments and client needs, pool their efforts and become more complementary in certain fields, and form alliances on a European and world scale, while observing Community competition rules.

If firms can make a clear and unequivocal commitment to activities of this kind, supported by the new market conditions and in accordance with the rules of competition, it is up to the Community or the Member States, applying the principle of subsidiarity, to help create a favourable environment for them, taking into account in particular the importance of IT and electronics for the whole of society.

30. In order to back up firms' initiatives, the Community must identify the European interest before making proposals for measures to be taken in this field. One objective is to allow firms to have **access to the markets** for products, investment and technologies. The completion of the internal market is an essential contribution to this but firms will need time to take advantage of all the opportunities it offers. This may not be enough, however. In a context of the move towards global markets and substantial economies of scale, production geared to the world market has become essential. IT and electronics firms are increasingly inclined to manufacture their products on the spot, so as to take advantage of the proximity of the market and the special relations with clients which result. Access to the markets must include the **possibility for direct investment and exports** in all parts of the world.

31. As a precondition for the expansion of European industry, it must also have **access to technology**. Indeed competitiveness cannot be achieved without it and without the latest products incorporating technology, given the expansion in trade, the growing interdependence of economies and the increasingly hot pace of the marketing of new products. This applies primarily to components; firms need satisfactory access to components so as to be able to continue to place innovative products on the market.

A second important condition, indissociable from access to markets and technologies, involves **mastery of technologies** in Europe. This may be unrelated to a firm's origins but is closely linked with the type of R&TD work it carries out in Europe and the way in which it disseminates its technologies outside. This means that the risk of a break in external sources of supply, especially in microelectronics, is reduced by the Community's capacity to develop products to deal with that eventuality, should it prove necessary. It also means the capacity to develop these technologies in harmony with European societal development.

A third factor relates to European firms whose basic markets are largely in Europe, with the positive effects on strategic decision-making, mastery of the technology and innovation in Europe which this entails. Firms with

the bulk of their activities taking place in Europe do not enjoy the same advantages as their competitors on their national markets, and face imperfections in the system of competition or failures of market mechanisms at international level.

It is against this background that the Commission is proposing Community action to help firms through the adjustment process which they are facing, and help them meet customer needs, without taking artificial measures to support them.

## II. Proposals for Action

There are five proposals altogether, relating to demand, technology, training, external relations and the business environment.

### Demand

32. The creation of **trans-European networks**, as advocated by the Commission, incorporating harmonized telecommunications services, will considerably stimulate the demand for IT and electronic equipment.<sup>10</sup>

33. **Computerized telecommunications links between administrations** must be set up as quickly as possible and a high level of interoperability of information systems achieved, while respecting human rights, in order to speed up integration of the European market. Preparatory R&TD activities are planned under the third framework programme (1990-94).<sup>11</sup>

34. This action must be accompanied by the launch of projects designed to modernize or create, with the help of computerized telecommunications, infrastructures in the fields of distance learning, transport, public health and the environment. Another project might relate to the gradual introduction of broadband services networks into the Community, in particular by the implementation of an international pilot project for a broadband network between research centres. Projects relating to a pan-European high-definition television service could also be studied and business applications found.

These infrastructures for meeting user requirements will necessitate substantial investments in the Member States over the next ten years. These investments will be all the more profitable and effective if they can draw on full-scale Community-wide trials.

The Community's role will be limited to providing the necessary impetus and coherence, helping to define overall projects, coordination—especially for the exchange of results—and taking the general measures for which it is responsible, for instance harmonization of architecture and protocols. The investment necessary to implement projects drawn up and prepared in this way will have to be largely financed by the parties concerned, although this does not necessarily rule out Community support, notably through the use of the appropriate financial engineering mechanisms.

35. Intensified joint efforts will be needed to **disseminate and exploit** the results of R&TD work on IT and electronics conducted at Community or national level or in a multinational framework such as Eureka.

The national bodies responsible for conducting these tasks will have to work together with the Commission's departments on computerized telecommunications networks and cooperation projects targeted primarily at SMEs.

36. **Increased user involvement** in the Community's technological development programmes will be sought, both in their initial phases and if they are extended, in particular in the context of Eureka.

### Technology

37. In order to keep pace with the extremely rapid rate of technological development in electronics and IT, satisfy the growth in demand and maintain an active role on a market which is becoming global in scale, the Community could consider launching a **second generation of R&TD**, ranging from projects at the precompetitive stage to projects geared more closely to the market.

This second generation, which is already emerging through the pilot projects being conducted under the third Community R&TD framework programme (1990-94) adopted by the Council on 23 April 1990, will be characterized in particular by the concentration of work on a smaller number of better targeted projects, closer cooperation with users, provision of training linked to advanced research and opening-up to international cooperation.

38. The guiding principles of the technology projects would rest on the following considerations:

1. It would make eminent sense to build further on points of strength in as far as they continue to offer, like software and CIM, potential for growth;
2. The frontier between computer software and hardware, predicated by the need to optimize the cost/benefit ratio, keeps moving towards ever more powerful systems, thanks to progress in microelectronics technologies, which allow more and more functions to be integrated onto one chip.

In a sense, it can be said that today's systems will be tomorrow's chips. It is therefore essential to master the technologies on which these components are based in order to secure the continued growth of the software and systems industries.

3. Most technologies are on the brink of radical change or a new generation, which offer opportunities for bridging existing gaps and taking the lead again. This is the case in priority areas, like microelectronics, peripherals and high-performance computing.

Projects implemented towards this end would need to be of different nature depending on the objective pursued.

**Mobilizing projects** aimed at accelerating technology take-up on a broad scale would thus need to be carried out alongside **integrating projects** aimed at mastering and consolidating a selected range of interdependent technologies.

These major projects, that would involve participation from all over the Community, would represent the core of R&TD effort and would have to be funded from the Community budget and as appropriate by national, regional or local sources, in particular within the context of Eureka.

Among the main objectives to be pursued, one could mention:

For **software**, to increase productivity by concentrating on production methods and tools and their early transfer to users in the framework of mobilizing project(s), involving notably SMEs.

Emphasis will be on software reusability well as on precompetitive work on both systems and applications interfaces.

The creation of a Trans-European Software Institute at the initiative of Community industry could receive Community support. Provision is made in the third framework programme for a pilot experiment (European Systems and Software Initiative).

For **computer-integrated manufacturing (CIM) and engineering**, to strengthen European manufacturing capabilities by the timely provision of the most powerful technologies of the IT and electronics industries. These will help to shorten design-to-product time, implement just-in-time strategies, and make for more flexible production, especially small, diversified runs under severe time constraints. These technologies are also essential for achieving decisive quality improvements.

For **microelectronics**, to develop integrated-circuit design and manufacturing technologies for both standard components (memories and logic circuits) and custom integrated circuits (ASICs), R&TD work building on and carrying further the collaboration established under JESSI [Joint European Submicron Silicon Initiative]. To supplement the above, efforts would need to be undertaken to provide **microprocessor** capabilities with particular emphasis on the definition of a family of new-generation architectures, securing compatibility and the transition from current-generation machines.

For **peripherals**, to establish capabilities for developing input/output devices and subsystems. Special attention should be given to high-resolution flat-panel display technology currently based on liquid crystals (LCD). A specific industrial commitment should be obtained on this. It is also essential for the development of consumer electronics.

For **high-performance computing (HPC)**, to take advantage of the possibility offered by progress in the field of parallel processing, through which computing power is

expected to be increased by a factor of 1000 by the end of the century. This will revolutionize the field and open horizons to applications for new users. This represents a major challenge in software. Once the complex software problems have been overcome, there should be rapid exploitation in many fields, such as simulation, forecasting and optimization in manufacturing industry, environment and meteorology. A project lasting ten years will probably be needed to master this new approach and all its implications. A preparatory phase is planned under the new programme on IT within the third Framework Programme.

For **telecommunications**, to respond to the growing demand for improved user friendliness, better economic return, faster response times and increasing freedom of choice and flexibility in integration of services. This should be achieved by the development "intelligent" networks, integration of flexible services, and the extension of multitasking capabilities to create or improve telecommunications networks while safeguarding data integrity and security. The objective would be to achieve response times and performance comparable to what is obtained today in companies' local area networks. Integrated broadband network technology provides both the capacity and the generic intelligence to respond to these user needs. Satisfying user demands requires a sustained effort of mobilizing and integrating technology and advancing international standardization at a rapid pace. Second-generation efforts should concentrate on the systematic development and validation of modular standardization of common parts of services enabling open service implementations to evolve with demand.

### Training

39. The Community urgently needs to train research scientists and engineers capable of developing and making maximum use of the new information technologies, where new generations are constantly emerging.

Multidisciplinary training measures could be launched or stepped up. They would be targeted at training staff and at staff engaged in production and management in firms using and supplying computerized telecommunications products and services. Training activities should also be developed to promote new forms of business management, integrating computer applications and advanced telecommunications in new management and production systems.

The Commission, in its communications to the Council on trans-European networks, has already proposed specific measures on vocational training.<sup>12</sup> The R&TD framework programme for 1990-94 also includes an entire specific programme devoted to developing human capital and promoting the mobility of research scientists. The Commission has also been involved for a number of years, notably since 1986, in the development of highly specialized programmes and initiatives on initial and continuing training in new technologies such as DELTA, COMETT, FORCE and EUROFORM.

Networks of excellence composed of both academic and industrial research teams, geographically distributed throughout the Community, will continue to be set up in order to provide a critical mass of complementary knowledge and expertise, and help to share limited and expensive resources.

### External Relations

40. The Community can help to sustain a competitive Community electronics and IT industry by adopting a trade policy based on the following six objectives:

- maintenance of an open, multilateral international trade system;
- the improvement of access to the markets of the main trading partners in electronics and IT (notably the United States, Japan and South Korea);
- establishment of fair competition in international markets;
- support for scientific, technological, industrial and commercial cooperation in the international arena;
- continuing integration of European markets by means of new agreements with EFTA and East European countries;
- economic restructuring aid for the East European countries.

41. The electronics and IT industries are directly concerned by the Uruguay Round of multilateral negotiations, and a satisfactory conclusion could make an important contribution to the achievement of the first two objectives.

The Uruguay Round "market access" negotiations are especially important for semiconductors and consumer electronics. Inconsistencies in the present tariff structure for semiconductors are liable to place the Community's processing industries at a competitive disadvantage. Within the constraints of the current global negotiations, the Commission will attempt to iron out these inconsistencies, while taking into account the respective interests of community producers and users.

On consumer electronics, the Community has offered less substantial tariff reductions to its trading partners on certain products. In addition, the Commission will insist on the need to remove the numerous non-tariff barriers which hinder imports of consumer electronic goods to some of our partners (in particular Japan).

The Community is paying close attention to the possibility of the renewal of the bilateral agreement on semiconductors between the United States and Japan which has important direct implications for all the Community's electronics and IT industry. The Commission will not hesitate to take action - as it did when the original

agreement was concluded, by calling for a GATT Panel - if the new agreement contains provisions which may be against the interests of the Community electronics and IT industries.

Moreover, in view of the damaging instability of supply prices on the world components market, the Commission believes that the OECD should be asked to set up a new consultative forum on semiconductors.

42. The commission will seek to ensure equitable conditions of competition and market access for both products and technologies at world level. As international competition intensifies and as markets become global, the fact that all companies competing in the world market are not operating under the same conditions of competition may cause particular problems for specific markets and products such as those in electronics.

For example, very large companies may use their extensive range of activities in the electronics sector to cross-subsidize certain products and activities and seek to gain market shares by undercutting their competitors. Similarly, in this sector, a high degree of vertical integration and the acquisition or existence of dominant positions could give rise to abuses in particular market segments, such as discriminatory practices, predatory pricing or refusal to supply. In the Community, if such practices were proved, they would be subject to the prohibition of Articles 85 and 86. The Community must insist that its competitors and the public refrain from such practices and that the public authorities put in place an efficient system to prevent such abuses. The response to external competitive pressures must be to secure a situation in which Europe's competitors refrain from unfair practices in their own or third country markets, not to modify the application of the rules in the Community. Competition policy strengthens European companies and is not a luxury to be discarded when there is competition from outside. New Community measures to control concentrations have an important part to play.

The Commission will investigate the existence of such practices among the Community's main competitors. If abuses and unfair practices can be shown to exist, pressure will be brought to bear on the relevant authorities. Identification of specific obstacles to fair competition followed by pressure on the public authorities has brought positive results in other sectors. For example, as a result of Community pressure, access has been granted to the Tokyo Stock Exchange. Partly as a reaction to international criticism, Japanese competition policy is being reformed and strengthened. The Japanese and US authorities must be pressurized to go further in this direction so as to bring about a situation where the main international trading partners can operate under roughly equivalent competition rules.

43. While meeting its international obligations, the Community will have to fall back, where necessary, on its customs regulations (temporary suspension of the autonomous duties of the common customs tariff) and

its trade policy instruments (such as anti-dumping measures and customs duties). In any event, the anti-dumping procedure can only be considered as a last resort. For this reason it is necessary to maintain detailed statistics and use all available bilateral and multilateral consultative fora in order to anticipate and avoid those situations which could result in the Community having no other choice than to take anti-dumping measures.

The Community applied the anti-dumping regulations to several electronics and IT products in the period 1985-90: semiconductors, photocopiers, printers, video recorders and television receivers. It seems that the effects of anti-dumping measures can vary, owing to the peculiarities of the markets for these products and the controversial impact of these measures on consumers and the industries which use components.

In any event, application of Article 115 will not be possible at the intra-Community borders once the internal market has been completed.

44. In the search for a balance between international cooperation and technological independence, firms should take responsibility for their strategic choices in this area, while the public authorities have the important role of providing appropriate frameworks for trade and cooperation.

45. The Community, in close collaboration with the industrialists concerned, has already taken part in international cooperation, for example in the field of standardization. Other opportunities are now emerging, such as the project for a programme on intelligent manufacturing systems (IMS). A number of areas of technological cooperation are currently being explored with American organizations. The Community itself should also seize the initiative in launching scientific cooperation programmes.

46. The Community will continue current negotiations with the EFTA countries with a view to creating a European economic area. The huge market which will be created in this way will offer fresh growth opportunities for the electronics and IT industries.

47. The Community must face up to its responsibilities vis-a-vis the Central and Eastern European countries and help them to bridge the technology gap and make good their inadequate infrastructure, especially in telecommunications. In time these countries will offer new opportunities and prospects for industrial cooperation. Their needs are very considerable: their production system must be adapted or changed and IT has a central part to play in their efforts to catch up.

#### The Business Environment

48. The implementation of the concept of industrial policy also calls for further measures in the field of electronics and IT designed to create a healthy business environment.

**59. Improving financing systems.** Given the importance of financing systems for firms which are capital-intensive and require high R&TD expenditure, the public authorities should hold discussions with banks and financial institutions on ways in which **risk capital** could be employed in conjunction with taxation measures.

Training schemes for staff in the banking sector encompassing both the financial side and computerized systems applications should also be looked into.

**50. Faster standardization and integration of standards into products** (hardware and software). Since products now become obsolete so rapidly, European firms are finding it increasingly difficult and costly to manage the evolution of standards. Ways of speeding up the procedures for drawing up standards, especially those relating to software, should be studied with European and national standards institutes.

European industry must also build new standards into its products and systems more quickly, like its foreign competitors, so as to derive maximum benefit from such standards, and must play an active role in the European, foreign and international standards bodies.

**51. Closer involvement of the development of electronics and IT in the introduction of structural policies.** The structural Funds make a significant contribution to the development of the less prosperous regions, by promoting the infrastructure for technology transfer, the dissemination and exploitation of research results, and the launching of training schemes in science, technology and management. These measures are among the priorities for development established, for each of the Community's less-favoured areas, within the Community support framework. In addition to these measures, the Commission has adopted a series of Community initiatives such as STRIDE, STAR, TELEMATIQUE and PRISMA. These initiatives help to create an environment that favours the development and dissemination of new technologies in firms, especially small businesses, in these regions. These structural measures should continue, and be better targeted where necessary, especially in the most disadvantaged areas.

**52. Developing infrastructure for cooperation.** The dialogue between the various groups involved needs to be stepped up, a move which could lead to the formation of partnerships.

Special measures could be considered or stepped up to help SMEs to expand their networks and step up their activities beyond their national frontiers.

Pilot operations for cooperation between SMEs, large firms and research centres at Community and international level should be launched, multi-sectoral basic technologies promoted in the framework of overall technology policy and the need for major industrial investments in basic components required for future generations of data-processing and electronics products taken into consideration.

The progressive integration into components of the functions contained in information and communication systems requires an improvement in cooperation between semiconductor manufacturers and users.

The Commission will continue its efforts to facilitate the formation of such cooperative partnerships.

**53.** This communication is intended to serve as background for a debate with the Member States, the European Parliament, the Economic and Social Committee as well as the industries, manufacturers and users concerned, in order to analyse the situation as perceived by the Commission and discuss the action to be taken.

This should enable the Commission to enter into fruitful dialogue with industry, users and investors, in order to assess the situation in greater depth from a dynamic perspective and to identify conditions for a long-term recovery, while respecting the roles of the parties concerned.

#### Footnotes

1. Commission communication on industrial policy in an open and competitive environment (COM(90)556).

2. **Components:** passive components, active components including memories, microprocessors, microcontrollers, application-specific integrated circuits (ASICs), etc.

3. **Computers:**

— **hardware:** portables, microcomputers, minicomputers, work stations, mainframes, network equipment, etc. and **peripherals:** printers, discs, screens, etc.

— **software:** packages and applications, information systems, systems engineering and services, etc.

— **office automation:** photocopiers, facsimile machines, dedicated terminals, etc. and **industrial automation:** numerically-controlled machine tools, robots, sensors, computer-aided design, manufacturing and management, computer-integrated manufacturing systems, etc.

4. **Consumer electronics:** TV, video tape recorders, video cameras, videodisc players, compact disc players, etc.

5. Source: EIC.

6. It should be noted that American and Japanese companies create less value added per employee in Europe than in their domestic markets.

7. See in particular M. E. Porter: "The Competitive Advantage of Nations", Harvard Business Review, March-April 1990, and The Free Press, New York, 1990.

8. European demand is estimated to be two to three years behind the American and Japanese markets and is reluctant to buy until new innovative products spread onto external markets.

9. The financial costs for R&TD in Japan are substantially less than in Europe. A recent study published by the Federal Reserve Bank of New York shows that, in the medium term, costs may vary by up to 10 percentage points. Long-term investments made by Japan simultaneously on all fronts are colossal and their origin cannot in any way be explained by profit margins on the domestic or external markets. Furthermore, in Japan the major groups are concentrated around a bank which participates directly in strategic development decisions

and their financing. Access to financial resources is therefore secure and not dependent on the firms' short-term profits.

10. "Towards trans-European networks - for a Community action programme" (COM(90)585 final).

11. Proposal for a specific programme on the development of telematics systems in areas of general interest.

12. "Towards trans-European networks: Objectives and possible applications" (COM(89)643 of 18 December 1989) and "Towards trans-European networks - for a Community action programme" (COM(90)585 of 5 December 1990).



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